

# Dental radiology reporting status and recording frequency of reporting items in Korea

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## ABSTRACT

**Purpose:** This study investigated the current dental radiology reporting methods and the recording rate of 10 mandatory reporting items in Korea.

**Materials and Methods:** An original online survey created using Google Forms was distributed to dental practitioners. The survey asked about the participants' age, experience, workplace, use of radiologic equipment, radiology reporting methods, and recording reporting items.

**Results:** In total, 354 responses were analyzed. Radiologic reporting in dental charts was the most commonly used method for each modality. Four out of 10 mandatory items were recorded at a high rate, but the remaining 6 items had substantially lower recording rates, often below 50%. The participants who reported radiographic findings through other separate methods had higher item scores than those who wrote findings in dental charts ( $P < 0.05$ ).

**Conclusion:** Radiologic societies and dental associations should encourage the use of separate reports for radiographic examinations. Education regarding radiology reports and the justification for reporting items should be reinforced in dental schools, training courses on radiology, and the continuing education curriculum. (*Imaging Sci Dent* 2023; 53: 35-42)

**KEY WORDS:** Dental records; Panoramic Radiography; Cone-Beam Computed Tomography

## Introduction

Imaging is an essential part of the diagnosis in dental clinics. Radiography provides information regarding the patient's condition that is not obtainable through a clinical examination or history-taking. Image interpretation and recording have a direct impact on the quality of treatment and communications during diagnosis, treatment, and follow-up. To provide optimal patient care, it is important to minimize the risk of communication errors between radiologists and clinicians.

In the field of medicine, some guidelines have been established for adequate radiology reporting systems.<sup>1-6</sup> According to those guidelines, a radiologic examination starts from the decision to take an image and ends with the final

report of the image. The American College of Radiology guideline stipulates the components of the report, principles of reporting, and referral and communication policies.<sup>1</sup> It recommends that components include demographics, relevant clinical information, the body of the report, and the impression using a standardized computer-generated template. Moreover, the UK guideline specifies the qualifications of the reporting doctors.<sup>5</sup> The Korean Society of Radiology developed a guideline for radiology reports and imaging protocols, and its report components include demographics, clinical information, the imaging technique, findings, and conclusion.<sup>6</sup>

However, radiographic examinations are quite simple in dental clinics, especially with intraoral radiography. Usually, radiography is performed as part of an everyday dental examination, and the dentist acts as the referrer, practitioner, interpreter, and reporter; therefore, the reporting system in dental clinics has received much less attention. Although the radiation exposure of dental radiography is much lower than that of medical examinations, it does also carry the potential for harm.<sup>7</sup> With the widespread use of cone-beam computed tomography (CBCT), the efficiency

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of the examination and reporting systems has become more important. Therefore, radiologic examinations should be taken with care and justified, and the justification for subjecting the patient to radiation exposure should be given in the radiology report; however, only a few studies are available about reporting guidelines in dentistry.<sup>8-10</sup> In Korea, even dental college hospitals use their own report forms, and there are no standards for the components or templates of radiology reports.

Considering the importance of reporting, the National Health Insurance Service (NHIS) of Korea has stated that it is mandatory to write a separate radiology report for every examination and to include the following 10 essential items: the patient's name, age, sex, name of the examination, date of the examination, image findings, diagnosis, date of the report, name of the reporting dentist, and name of the clinic.<sup>11</sup> If no radiology report is made, only 70% of the payment is given for image-taking, and 30% of the payment for the report is cut.<sup>12</sup> This reporting rule applies to both medicine and dentistry, and there are no other regulations on dental radiology reports. However, these regulations are insufficient compared to other medical report guidelines<sup>1-6</sup> and no study has reported data on the templates, reporting items, or recording rate of essential items in Korea.

Therefore, this study investigated the reporting methods and recording items currently used by dentists in Korea, as well as the recording rate of the 10 mandatory reporting items.

## Materials and Methods

To collect the nationwide status of dental radiology reporting in Korea, a survey created using Google Forms was posted online on the website of the Korean Dental Association (KDA) and also distributed to the members of the KDA via text messages from November 4 to 28, 2016 (Table 1). The KDA's website is the best place to collect nationwide responses from all Korean dentists, since all Korean dentists are members of the KDA, and content on the KDA's website can only be accessed by dentists.

The survey was anonymous and included 10 closed-ended questions about participants' age, experience, workplace, modalities of radiologic equipment used (periapical radiography, panoramic radiography, computed tomography), methods of radiology reporting (writing in dental charts, separate written report in dental charts, report in a picture archiving and communication system [PACS] viewer program, a separate report in an electronic chart program) for

each modality, and the reporting items for each modality. Multiple answers were allowed for the questions about the modalities of radiologic equipment and the reporting items for each modality. For the reporting item question, 19 items (patient's name, age, sex, chart no., social identification no., clinical information, the name of the examination, date of the examination, the name of the referrer, the license no. of the dentist, the name of the practitioner, image findings, diagnosis, the date of the report, the name of the reporting dentist, limitations, issues with the examination, the name of the clinic, and the contact no. of the clinic) were presented, and participants were asked to select the items they recorded in the radiology report. Ten of the 19 items were mandatory, and the selected number of mandatory items was defined as the reporting item score.

In total, 386 voluntary responses were received, and inadequate/blank or contradictory answers were excluded. Furthermore, answers including fewer than 4 of the 19 reporting items were also excluded. After the exclusion of 32 responses, 354 responses were included in the study.

Survey responses were downloaded as a Microsoft Excel version 2007 file (Microsoft, Redmond, WA, USA), and the distribution of age, workplace, methods of radiology reporting, and reporting item scores were calculated. Statistical calculations were conducted using IBM SPSS Statistics version 24 (IBM Corp., Armonk, NY, USA). The independent t-test was used to evaluate the differences in reporting item scores according to the methods of radiology reporting and workplace, with statistical significance set at  $P < 0.05$ .

## Results

The participants were all dentists; their age was mainly in the 30s and 40s, with a normal distribution (Table 2). The experience of participants was well distributed, and more than 60% of them had at least 10 years of experience (Table 2).

Most participants worked in dental clinics ( $n = 272$ ; 76.8%), followed by dental hospitals and university dental hospitals ( $n = 41$ ; 11.6% for both) (Table 3).

Digital panoramic radiography was the most common modality, reported by 331 (93.5%) out of 354 participants, followed by digital periapical radiography ( $n = 303$ ; 85.6%), computed tomography including both cone-beam and multidetector computed tomography ( $n = 222$ ; 62.7%), conventional periapical radiography ( $n = 65$ , 18.4%), and conventional panoramic radiography ( $n = 20$ ; 5.6%) (Table 4).

**Table 1.** Questionnaire survey on dental radiology reporting in Korea

This survey aims to identify the current reporting methods and reporting items of dental radiology used conducted by members of the Korean Academy of Oral and Maxillofacial Radiology. The following questionnaire will require approximately 5-10 minutes to complete. Thank you for taking the time to complete this survey. Additionally, we will keep your responses anonymous and confidential, and only use them for academic purposes.

By clicking “Agree” below, you agree to participate in this survey at your will, and you can withdraw from the survey at any time after starting it.

☐ Agree

1 What is your age? (Check the corresponding circle)

☐ ≤30   ☐ 31-40   ☐ 41-50   ☐ 51-60   ☐ ≥61

2 How much experience do you have? (Check the corresponding circle)

☐ ≤5 years   ☐ 6-10 years   ☐ 11-20 years   ☐ ≥21 years

3 What is your workplace? (Check the corresponding circle)

☐ Local clinic   ☐ Dental hospital   ☐ Dental college hospital

4 Which of the following methods do you use? (Choose all applicable options)

☐ Periapical radiography (film)   ☐ Periapical radiography (digital)

☐ Panoramic radiography (film)   ☐ Panoramic radiography (digital)

☐ Computed tomography (including both CBCT and conventional CT)

5 Which of the following methods do you use when you report periapical radiographic images? (Check the corresponding circle)

☐ Reporting periapical radiography is not applicable.

☐ Write it in the dental chart without making a separate report.

☐ Make a separate written report and keep it in the dental chart.

☐ Report in a PACS viewing program.

☐ Make a separate report page in an electronic chart program.

6 Which of the following items do you record when you report periapical radiographic images? (Choose all applicable options)

☐ Patient's name   ☐ Age   ☐ Sex   ☐ Chart no.   ☐ Social identification no.

☐ Clinical information   ☐ The name of the examination   ☐ Date of the examination

☐ Referrer   ☐ License no. of the dentist   ☐ The name of the practitioner

☐ Image findings   ☐ Diagnosis   ☐ Date of the report   ☐ The name of reporting dentist

☐ Limitations   ☐ Issues with the examination   ☐ The name of the clinic   ☐ Contact no. of the clinic

7 Which of the following methods do you use when you report panoramic radiographic images? (Check the corresponding circle)

☐ Reporting panoramic radiography is not applicable.

☐ Write it in the dental chart without making a separate report.

☐ Make a separate written report and keep it in the dental chart.

☐ Report in a PACS viewing program.

☐ Make a separate report page in an electronic chart program.

8 Which of the following items do you record when you report panoramic radiographic images? (Choose all applicable options)

☐ Patient's name   ☐ Age   ☐ Sex   ☐ Chart no.   ☐ Social identification no.

☐ Clinical information   ☐ The name of the examination   ☐ Date of the examination

☐ Referrer   ☐ License no. of the dentist   ☐ The name of the practitioner

☐ Image findings   ☐ Diagnosis   ☐ Date of the report   ☐ The name of reporting dentist

☐ Limitations   ☐ Issues with the examination   ☐ The name of the clinic   ☐ Contact no. of the clinic

9 Which of the following methods do you use when you report computed tomographic images? (Check the corresponding circle)

☐ Reporting computed tomography is not applicable.

☐ Write it in the dental chart without making a separate report.

☐ Make a separate written report and keep it in the dental chart.

☐ Report in a PACS viewing program.

☐ Make a separate report page in an electronic chart program.

10 Which of the following items do you record when you report computed tomographic images? (Choose all applicable options)

☐ Patient's name   ☐ Age   ☐ Sex   ☐ Chart no.   ☐ Social identification no.

☐ Clinical information   ☐ The name of the examination   ☐ Date of the examination

☐ Referrer   ☐ License no. of the dentist   ☐ The name of the practitioner

☐ Image findings   ☐ Diagnosis   ☐ Date of the report   ☐ The name of reporting dentist

☐ Limitations   ☐ Issues with the examination   ☐ The name of the clinic   ☐ Contact no. of the clinic

For the methods of radiology reporting, most of the participants recorded imaging findings in dental charts with clinical information, followed by imaging viewer programs, and separate report pages in electronic chart programs (Table 5).

**Table 2.** The distribution of the participants' age and experience

Age	Number (%)	Experience	Number (%)
≤ 30	34 (9.6%)	≤ 5 years	85 (24%)
31-40	118 (33.3%)	6-10 years	52 (14.7%)
41-50	114 (32.2%)	11-20 years	115 (32.5%)
51-60	68 (19.2%)	≥ 21 years	102 (28.8%)
≥ 61	20 (5.6%)		
Total	354		354

**Table 3.** The distribution of the participants' workplaces

Workplace	Number (%)
Dental college hospital	41 (11.6%)
Dental hospital	41 (11.6%)
Local clinic	272 (76.8%)
Total	354

**Table 4.** The distribution of modalities of radiologic equipment

Modalities of radiologic equipment	Number (%)
Periapical radiography (film)	65 (18.4%)
Periapical radiography (digital)	303 (85.6%)
Panoramic radiography (film)	20 (5.6%)
Panoramic radiography (digital)	331 (93.5%)
Computed tomography (cone-beam and multidetector)	222 (62.7%)
Total	354

**Table 5.** Methods of radiology reporting by modality

Methods of radiology reporting	Periapical radiographs	Panoramic radiographs	CBCT or CT images
Writing in the dental chart	274 (78.5%)	273 (78.7%)	106 (47.7%)
Separate report page in the dental chart	3 (0.9%)	0 (0%)	34 (15.3%)
Report in a PACS viewer program	47 (13.5%)	49 (14.1%)	47 (21.2%)
Separate report page in an electronic chart program	25 (7.2%)	25 (7.2%)	35 (15.8%)
Total	349	347	222

CBCT: cone-beam computed tomography, CT: computed tomography

Four mandatory items (patient's name, age, sex, and date of the examination) were recorded in most cases, but the remaining 6 items were recorded less often, with frequencies below 50% (Table 6). The least frequently recorded mandatory item was the name of the reporting dentist. The average reporting item scores were around 5.5 to 6 points for each modality.

A significant difference in reporting item scores was found according to the reporting method (Table 7). The participants who reported using other methods recorded higher item scores than those who wrote the findings in dental charts. No significant difference in item scores was found according to whether participants worked at local clinics or dental hospitals.

## Discussion

A radiology report is the result of an examination and documents the important components and findings of the examination. The report is crucial for an accurate diagnosis, is a key communication tool between radiologists and clinicians, and is also a medico-legal document. The Korean Academy of Oral and Maxillofacial Radiology has yet to recommend a reporting guideline. The NHIS made a regulation about radiology reports, but this regulation is relatively simple compared with other international guidelines.<sup>1-5</sup> The NHIS of Korea designated 10 mandatory items to be included in radiology reports.<sup>11</sup> If no radiology report is made, only 70% of the payment is given for image-taking, and 30% of the payment for the report is cut.<sup>12</sup> However, no study has yet investigated whether radiology reports are made in accordance with the NHIS regulations or investigated statistics on payment cuts due to a lack of a radiology report. As a basic study of the radiology report system, this study investigated the current reporting methods and the recording rate of 10 mandatory reporting items in Korea.

The average reporting item scores were about 5.5 to 6

**Table 6.** Recording frequency of reporting items and average reporting item scores

Report items		Periapical radiography	Panoramic radiography	CBCT or CT images
Ten mandatory items	Patient's name	325 (93.1%)	324 (93.4%)	219 (98.6%)
	Age	296 (84.8%)	307 (88.5%)	211 (95.0%)
	Sex	278 (79.7%)	287 (82.7%)	200 (90.1%)
	Name of the examination	94 (26.9%)	92 (26.5%)	77 (34.7%)
	Date of the examination	289 (82.8%)	260 (74.9%)	178 (80.2%)
	Image findings	157 (45.0%)	152 (43.8%)	123 (55.4%)
	Diagnosis	126 (36.1%)	129 (37.2%)	101 (45.5%)
	Date of the report	123 (35.2%)	123 (35.4%)	107 (48.2%)
	Name of reporting dentist	87 (24.9%)	80 (23.1%)	86 (38.7%)
	Name of the clinic	116 (33.2%)	120 (34.6%)	87 (39.2%)
Nine other items	Name of the referrer	71 (20.3%)	55 (15.9%)	55 (24.8%)
	License no. of the dentist	28 (8%)	29 (8.4%)	35 (15.8%)
	Name of the practitioner	20 (5.7%)	22 (6.3%)	24 (10.8%)
	Chart no.	309 (88.5%)	312 (89.9%)	213 (95.9%)
	Social identification no.	113 (32.4%)	113 (32.6%)	67 (30.2%)
	Clinical information	79 (22.6%)	81 (23.3%)	50 (22.5%)
	Limitations of the examination	7 (2%)	8 (2.3%)	11 (5.0%)
	Issues with the examination	44 (12.6%)	43 (12.4%)	28 (12.6%)
Contact no. of the clinic		43 (12.3%)	37 (10.7%)	31 (14%)
Total		349	347	222
Average reporting item score		5.68	5.54	5.96

**Table 7.** Report item scores according to methods of reporting and workplace (by the independent t-test)

Factors	Periapical radiograph	<i>P</i>	Panoramic radiograph	<i>P</i>	CBCT or CT images	<i>P</i>
Writing in the dental chart	5.22	<0.05	5.13	<0.05	4.88	<0.05
Other methods	7.1		7		6.99	
Local clinic	5.67	0.901	5.52	0.662	5.93	0.642
Dental hospital	5.71		5.65		5.12	

CBCT: cone-beam computed tomography, CT: computed tomography

points in each modality. The patient's name, age, sex, and date of the examination were recorded in most cases, but the remaining 6 items were recorded by fewer than 50% of participants. The rate of participants who recorded all mandatory items was very low; however, this study only analyzed survey responses and was not an audit, so this result may not necessarily reflect the real situation. In particular, it might not be the case that all of the other information is missing, since basic items such as the name of the clinic or the name of the reporting dentist are usually recorded in the clinical chart. However, this result is thought to re-

flect participants' perception that the patient's name, age, sex, and date of the examination are essential items, while other items are not. This means that if a radiology report is recorded in the dental chart, there may be a high chance of omission. In contrast, participants who reported through other methods had higher item scores than those who wrote the reports in dental charts. A reason for this finding may be that a separate method needs its own report format, there would be places in the template to fill out for the reporting items, and dentists who use those methods would be more familiar with the reporting items. This is only speculation,

and no study has yet specifically investigated this issue, but it is clear that more attention needs to be paid to legitimate reporting in Korea.

It was initially hypothesized that the item scores would be higher among participants who worked at dental hospitals due to their PACS systems, but there were no significant differences from the item scores of participants who worked at local clinics. At dental hospitals with a radiology department, it is assumed that radiologists report most of the images, and other dentists are not supposed to write radiology reports and might not be interested in reporting items. This report did not ask about dentists' specialties, and the results of radiologists and dentists with other specialties could not be separated.

In medicine, radiology report guidelines proposing major principles of reporting have been established and revised by radiology associations.<sup>1-6</sup> Those medical guidelines include statements about the components of the radiology report, reporting principles, communication methods, and qualifications of the radiologist. However, there is no official report guideline in the dental field, and only a few guidelines for radiation protection or record-keeping have been published about radiography reports.<sup>8,9,13</sup> The European guideline for radiation protection states that "All radiographs must be evaluated by the dentist and an appropriate report on the radiological findings made."<sup>7</sup> Another guideline of the National Radiological Protection Board notes, "Clinical evaluation does not necessarily have to be a full radiology report, but should show that each radiograph has been evaluated and should provide enough information."<sup>9</sup> That guideline does not clearly describe the difference between a clinical evaluation and a full radiology report nor the composition of radiology report. The statement about recording a clinical evaluation, not a full report, seems to consider the simplicity and self-referred characteristics of dental radiology examinations as part of everyday dental treatment.

The NHIS of Korea developed a simple rule that a radiology report must contain 10 essential items.<sup>11</sup> Unlike the other guidelines, it does not include a description of the justification.<sup>7,9,11,13</sup> There are no universally accepted rules for the definition, structure, and components of a radiological report, but most guidelines require justification and reporting of the radiographs.<sup>1-7,9,13</sup> Even the guideline that only requires a clinical evaluation, not a full radiology report, recommends recording the justification.<sup>13</sup> To justify the radiation exposure due to radiography, it is essential that the decision to perform appropriate radiography is based on the individual patient's history and a clinical examination.

The "routine" use of radiography is unacceptable.<sup>7</sup>

With plain dental radiographs, the effective dose and risk are relatively low.<sup>7</sup> However, CBCT has higher radiation doses than traditional dental radiography, and recording the justification for CBCT images is much more important. CBCT has become widespread in the dental field due to its 3-dimensional images with high spatial resolution, and 62% of participants in this study utilized CBCT devices. There is no additional legal requirement for a radiology report or recording the justification for dental CBCT in Korea. About 47% of participants who used CBCT responded that they recorded findings in dental clinical charts instead of writing separate reports. This situation needs to be improved, and dentists should be careful about the dose, reports, and justification for CBCT. For reference, some guidelines on the clinical use of CBCT also agree on the fundamental principle that CBCT could be justified when conventional radiographs do not answer the diagnostic question for which imaging is required.<sup>14</sup>

Another concern is that hybrid panoramic/CBCT scanners have become more prevalent.<sup>15</sup> Hybrid CBCT scanners are relatively low-cost compared with dedicated CBCT scanners, and even comparable to the price of digital panoramic scanners. Hybrid CBCT scanners allow dentists to take in-clinic CBCT images directly instead of through external referrals, and to have the chance to make additional income. As old panoramic equipment requires replacement, dentists are more likely to introduce hybrid CBCT scanners. Such a change will increase the opportunity for self-referrals, meaning that the referral, justification, interpretation, and reporting can be performed by the same dentist. With these changes in CBCT and hybrid scanners, it is more important to include justification as a mandatory report item.

There are additional issues with self-referral besides justification. The literature has shown that self-referral can involve the non-detection of pathology, poor awareness of radiation exposure, and imaging faults.<sup>16-18</sup> The American Academy of Oral and Maxillofacial Radiology also emphasizes that self-reporting practitioners are responsible for the interpretation and findings, just as biopsies are accompanied by a pathology report.<sup>19</sup> The result of this study, while limited, also show that the reporting is not properly conducted in a self-referral environment, which is consistent with the results of a survey from Australia.<sup>20</sup>

In radiologic examinations, the radiation dose is as important as the justification. Some guidelines include the radiation dose as a component of the report.<sup>3,21</sup> However, there are no universally accepted rules for dose reporting.

Measuring the effective dose would be the most exact method, but it is impossible to do so for every examination. Further studies are needed to develop standardized methods for dose measurement and reporting.

The radiology reporting committee of the Radiological Society of North America (RSNA) recommended the use of structured reports to improve the communication of radiologic examination results.<sup>21</sup> Radiology report information that has been entered with consistent formats and terminology can be more easily retrieved by both human readers and information systems and analyzed to support medical research and quality improvement analyses, as well as to assess features of the report itself. Formatting consistency also allows the automated or semiautomated abstraction of reporting data. In this study, the participants who reported using other methods had higher item scores than those who wrote the information in dental charts. The RSNA founded radreport.org<sup>22</sup> with the European Society of Radiology and has been collecting structured reporting templates for numerous modalities for different body parts. The templates can be downloaded for free from the website. In addition, the American College of Radiology has developed 10 reporting and data systems<sup>23</sup> by committees composed of relevant radiologists and clinicians, and these systems use standard terminologies in a structured format to describe findings to facilitate data collection from imaging. In the dental field, a few studies have also reported the need for structured reporting.<sup>24-26</sup> Harvey and Patel<sup>24</sup> suggested reporting formats for several diagnostic tasks of CBCT images, and Singh et al. proposed a structured reporting format for computed tomographic images of temporomandibular joint ankylosis. Pahadia et al.<sup>26</sup> discussed report-writing skills and the need for a structured format.

In conclusion, radiologic societies and dental associations should encourage the use of separate reports for radiographic examinations. The justification of a radiologic examination needs to be determined as a mandatory reporting item as CBCT equipment becomes increasingly widespread. Education regarding the radiology report and the justification for radiography should be reinforced in dental school, training courses in radiology, and the continuing education curriculum.

**Conflicts of Interest:** None

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